

The coordination of activities related to geographic information and GIS in Florida is led by the Growth Management Data Network Coordinating Council, an interagency body established by statute in 1985 to direct Florida's statewide growth management efforts. In 1988 the Council recognized that 80% of the decisions made in state government are related to geographic information, and GIS is the tool necessary to manipulate these data. The Council members signed an interagency agreement creating a federation of independently held databases linked together by standards and a management structure, known as the Florida Digital Spatial DataBase System. Significant actions by the Council and its Staff Advisory Committee include the development of the Florida Spatial Data Directory, an automated catalog of spatial information, and the creation of a methodology for the development of standards for specific data sets. A Base Mapping Advisory Committee is being established to serve as a technical advisory committee to the Council for both manual and digital maps. Following funding approval by the 1991 legislature, the state and the U.S. Geological Survey began a joint project to update and digitize all of the state's 1:24,000 scale quadrangle maps. Florida's Department of Natural Resources and the Department of Environmental Regulation are state government's primary users of GIS, with accelerated activity this decade. For example, the Preservation 2000 Act of 1990 authorized bonding capability for up to \$300 million per year for the acquisition of conservation and recreation lands and for the development of a plan for a public lands GIS.

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Origins of State Initiatives

Florida began its investment in and coordination of geographic information in the early 1970s. The Florida Water Resources Act of 1972 provided for funds to be set aside "to accelerate topographic mapping" in the area of the South Florida Water Management District. In addition to requiring the district to earmark those funds, the Department of Transportation was directed to annually set aside \$30,000 while the Board of Trustees of the Internal Improvement Trust Fund was autho-

rized and directed to allocate \$10,000 each year from the Land Acquisition Trust Fund for mapping in this area. These funds were designated for topographic work to be conducted by the U.S. Geological Survey (USGS). This statute authorized what is known as a Joint Funding Agreement (JFA) between the state and USGS.

During the same year, the legislature adopted the *Florida State Comprehensive Planning Act of 1972*. This and subsequent legislation established the framework and basis for statewide land use

planning in Florida, including development of regional planning centers and a statewide comprehensive plan. State water management districts were established by the legislature in the 1970s. GIS activities in Florida began when these districts began to plan for water resource needs. For example, the South Florida Water Management District began use of automated mapping in 1977. During the 1980s it used Computervision and AutoCAD systems to develop digital versions of 7.5 minute USGS quadrangle sheets, drainage basin models, canal alignments and structure locations, rainfall maps, land use maps, and others.

The Florida Landsat Demonstration Program, began in 1977, was initiated to demonstrate the usefulness of satellite imagery, and was part of the National Aeronautics and Space Administration's (NASA) Technology Transfer program. The Swannee River Water Management District was chosen as a demonstration area and assistance was provided by the Stennis Space Center in Mississippi. The Florida Governor's Office and state agencies including the Departments of Natural Resources (DNR), Environmental Regulation (DER), and Transportation (DOT) participated in an evaluation team for the project. The project introduced new technology, but it ended in 1981 when federal funding was reduced.

DNR next began to work with remote sensing and GIS, and the agency requested funds to purchase equipment and software, and to provide the staff necessary to implement GIS services which could serve statewide needs. The requested funds were not approved for the initiative, however; DNR then requested funding from the National Oceanic and Atmospheric Administration's (NOAA) Coastal Zone Management Program in 1982 to create the Marine Resources GIS (MRGIS) in the Division of Marine Resources. MRGIS essentially became a pilot project for DNR, using NASA's ELAS software. The division informally served as a repository for GIS and as the state's remote sensing advisor for other agencies. It began a base inventory on marine and estuarine habitats, and conducted the project with the Florida DOT.

In 1983, the legislature approved funding of \$400,000 (nearly the amount that DNR had originally proposed) for statewide GIS. These funds were approved for DOT to conduct state mapping using photography and satellite imagery for land use and land cover data. DOT purchased equipment similar to that owned by DNR's Division of Marine Resources and ELAS software, and the agencies continued to work together. Its first application was to evaluate conversion of agricultural lands to developed lands, which continued through the 1980s. DOT also began using CAD software in the early 1980s.

At the same time, DER's Bureau of Information Systems (BIS) began use of a terminal connected to a host computer at the Florida Resource and Environmental Analysis Center (FREAC) at Florida State University. Installed in 1982, the system was established to provide automated cartographic support for the entire agency. Demand for use of the system increased during the 1980s. DER's Bureau of Ground Water Protection also acquired an Intergraph system in 1983.

Florida's Information Resources Commission (IRC) was created by the legislature in 1983. It was charged with and continues to lead and provide statewide direction for information resource management, including all information technology and policy and planning throughout state government.

In 1984, the Florida Legislature directed the Department of Community Affairs (DCA) to map and monitor land use via LANDSAT satellite imagery. Known as the Florida Land Use Data System (FLUDS), work was performed with DOT and FREAC, with support from IRC. Various demonstration projects were conducted, and the project received national publicity and acclaim. For example, in 1986, the DCA effort was one of eight innovative state government programs in the nation selected annually for recognition by The Council of State Governments. Funding became limited, however, after the effort was initiated.

DCA began compiling soil survey information as part of this effort, and in September 1985, a study plan for building a digital soil survey database for Florida was developed. The state initiated work with the U.S. Soil Conservation Service (SCS) to develop both manual and digital versions of soils data for Florida. Funding was also limited for this initiative but continued on a limited, county-by-county basis.

Increasing growth pressures in Florida led then Governor Bob Graham to encourage statewide attention and planning, particularly concerning increasing infrastructure needs. The *Local Government Comprehensive Planning and Land Development Regulation Act of 1985* was adopted to accommodate growth and it mandated a program of local planning and policies which encourage compact urban expansion, restrictions on coastal development, and the requirement that infrastructure be in place at the same time as development. DCA was authorized to review and approve local land use plans (see **Coordination Efforts, Groups and Activities**, Regional and Local Government Relations and Programs).

At the same time that the act was adopted, the Florida Growth Management Data Network Coordinating Council was created by statute. Composed of state agency leaders, the Council was

charged with leading the coordination of growth management information. GIS was considered to be an important tool to assist in this regard. A Staff Advisory Committee composed of representatives of the same agencies was created to advise the Council (see **Coordination Efforts, Groups and Activities**). Its initial focus (1985-87) was on data processing and telecommunications issues, and its efforts included demonstration of the technology and inventorying, in order to increase knowledge about existing and planned computer applications which would support growth management activities. Inventories of activities and database development were conducted as well as a pilot project to develop communications links between two agencies with dissimilar computing environments. While the project was accomplished in one sense, interagency sharing was not as successful as had been hoped. Accordingly, efforts then concentrated on data and the need for information management strategies, including a "logical system" of data administration practices (instead of a "physical system") to be used to support exchange of growth management information.

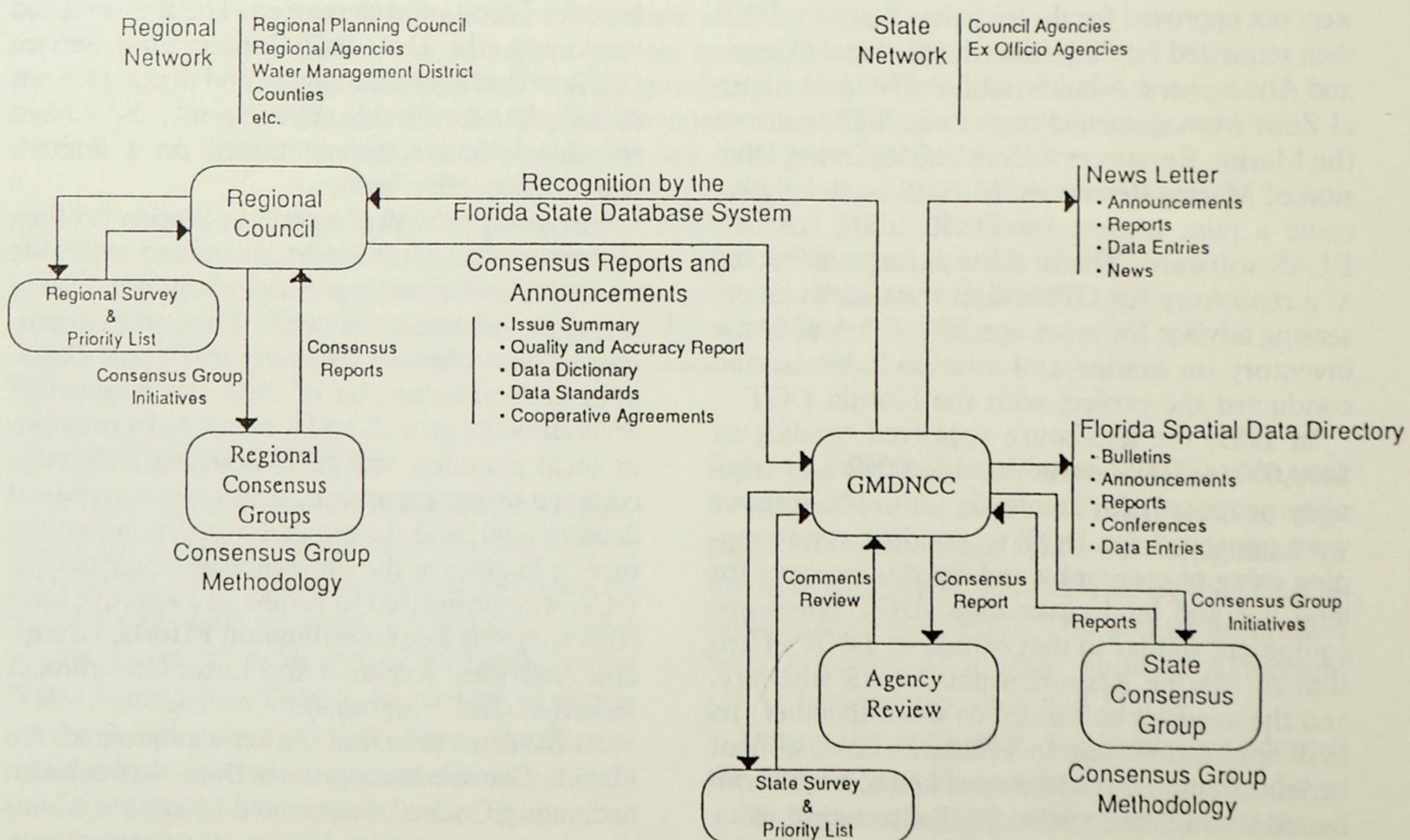
During the late 1980s, DNR, DER and DOT continued GIS work, and other agencies also began related activities. DER contracted with Arthur Young and Company in 1987 to perform a management information study. It recommend-

ed an integrated spatial database, and in July 1988, helped formulate plans to acquire department-wide GIS capabilities in the Agency IRM Plan. A four-person GIS section was created in October 1988, and GIS hardware and software systems were acquired following a needs assessment survey conducted by its staff. The Game and Fresh Water Fish Commission's Office of Environmental Services began development of a comprehensive Statewide Wildlife Habitat System in the mid-1980s. The Department of Agriculture and Consumer Services began evaluation of GIS in 1988.

At the same time, informal efforts among state agencies regarding GIS coordination were increasing, including a review of the proposed federal Spatial Data Transfer Standard, and discussions which concluded that a data dictionary would be appropriate. FREAC also conducted an inventory of GIS activities in 1987.

The Council initiated a "strategic data planning project" in 1988, resulting in the *Strategic Directions Report* that was published by the Council in September, 1988. A "business architecture" system for growth management was established which included functional and information models for the nine council member agencies (known as growth management agencies). Growth management functions identified include regulation and enforcement, as well as providing services and

State of Florida GIS Network



facilities, marketing, assessing environment, and availing resources. Subfunctions are designated for each of these functions. A matrix of the tasks and of the agencies that perform them was developed to help create an information model. This effort helped lead to the Council's conclusion that geographic information is critical to managing growth, and is a common link for interagency and inter-governmental decision making. This conclusion helped to formalize related coordination among agencies.

Florida's "growth management" act is known as possibly the strongest statewide planning legislation in the nation, since it provides state government with a strong voice in local land use activities, and accommodates growth with a mandated local planning program.

The report was adopted by the Council and received much positive support. Governor Martinez stated that "effectively managing Florida's rapid growth is a high priority of my administration. Achieving the goals set out in this report is an important component of managing Florida's growth. It is crucial that we, as key decision-makers, form a partnership to share vital state information across state, regional and local governments. I am aware that many local and regional governments have or are developing GIS to effectively manage growth. Several local and regional governments have approached state agencies for guidance in developing data standards for their GIS."

Following this project, the efforts of the Council and committee were concentrated on achieving objectives of the report's recommendations through the design and development of a "cost effective and technically sound approach to establishing a statewide network for the interagency transmission of growth management data." The Council concluded that a decentralized approach was needed and compatible computer hardware and software configurations were therefore not required.

Geographic information efforts in late 1988 included inventories of state agency data needs, data created, and hardware and software. The initiation of coordination meetings was led by the Council staff. Recommendations emerging from the effort included establishment of data structure, quality and accuracy standards; maintenance of a common base map and central index and directory of GIS data and sources; and formulation

of a GIS organization responsible for implementing a statewide GIS and interagency information sharing agreements.

The Council has published a report entitled *Annual Report: Florida Growth Management Data Network Coordinating Council* each year since 1986. These reports review accomplishments and future plans of the Council. Many efforts in 1989 focused on developing and finalizing an agreement to implement a network of independently operated and maintained digital spatial databases, which became known as the Florida Digital Spatial DataBase System. Additional efforts included work on the Florida Spatial Data Directory, and initiation of a coastal zone management project for GIS. The agreement was subsequently signed by the Council's member agencies and became effective September 1, 1989.



Coordination Efforts, Groups and Activities

Statewide geographic information coordination and development is led by the Florida Growth Management Data Network Coordinating Council. The Council was created in the same year as the *Local Government Comprehensive Planning and Land Development Regulation Act of 1985*, which followed the *Florida State Comprehensive Planning Act of 1972*, and similar legislation directing state, regional and local land use and growth management planning. Florida's "growth management" act is known as possibly the strongest statewide planning legislation in the nation, since it provides state government with a strong voice in local land use activities, and accommodates growth with a mandated local planning program (see below, Regional and Local Government Relations and Programs). The Council was directed to coordinate and promote from a management and planning perspective the interagency and inter-governmental sharing of data and information required to respond to growth management issues. The Council's goals include providing growth management direction and guidance to state, regional and local agencies.

In addition to this legislation, the 1990 State Legislature adopted the Florida Preservation 2000 Act. This act was adopted to purchase public lands and provided for GIS as part of this effort (see **GIS in State Government**, Department of Natural Resources and Legislative Activities).

The Council's members include directors of the nine agencies involved with growth management and of the Executive Office of the Governor, with the director of the Office of Planning and Budgeting (OPB) serving as chair. These agencies

include the Game and Fresh Water Fish Commission, and the Departments of Agriculture and Consumer Affairs, Commerce, Community Affairs, Health and Rehabilitative Services, Environmental Regulation (DER), Natural Resources (DNR), and Transportation. The Department of Revenue later joined the Council. The State's Information Resource Commission (IRC) and Division of Communication of the Department of General Services serve as ex-officio members of the Council. The OPB Director chairs the Council, and is assisted by the Council's Staff Director. Interested parties, such as water management districts, regional planning councils, local governments, and the private sector are encouraged to be involved as ex-officio members of the Council. The Council meets approximately every three months.

Florida has adopted a “consensus methodology” to help meet its focus on the development of digital data and standards for multi-agency needs.

The Council's initial efforts concerned information technology interfacing. It concluded that a decentralized but networked approach was needed, and thus compatible computer hardware and software configurations were not required (see **Origins of State Initiatives**). Since 1988 the Council has concentrated on data management and decisions rather than strictly on technology, with the perspective in mind that geographic information is critical to managing growth. It is seen as a common link and framework for interagency and inter-governmental decision making, and as help for the Council to meet its overall mission. Efforts concentrated on data networking and development of a strategic level information model including a “logical system” of data administration practices; establishment of data structure, quality and accuracy standards; maintenance of a common base map; and creation of central index and directory of GIS data and sources to facilitate information exchange.

The 10-page *Florida Growth Management Data Network Coordinating Council Interagency Agreement* describes how Council members are implementing the 1985 act. The agreement, signed by each of the nine growth management agencies, became effective on September 1, 1989, and was amended in November, 1990. It provides that the council agencies agree to:

- Promote the sharing of data related to growth management
- Promote consistency of data elements related to growth management
- Adopt common data elements and formats for interagency transmission of growth management data, and
- Prevent the duplication of effort associated with the collection of growth management data.

The agreement includes guidelines for a management structure which provides that:

- Within each agency, management priority and support shall be given to the organization and execution of work necessary for reaching consensus about agency responsibility for growth management data development, maintenance and exchange.
- Agencies shall work together to develop a management structure for the further development, application and review of proposed standards. The management structure should provide a mechanism to facilitate data exchange and avoid duplication and uncoordinated data collection activities.
- Agencies shall participate in the creation of consensus definitions of spatial data entities and optimize opportunities for streamlining data reporting and collection responsibilities.

The agreement authorizes the Florida Digital Spatial DataBase System (FDSDS), the Spatial Data Transfer Specifications (SDTS), the Florida Spatial Data Directory, and 16 standards which provide guidance to agencies developing GIS. (see below, Policies/Standards). The Council, with support from the Staff Advisory Committee (see below) and its staff, has developed a variety of documents, including a report entitled *Annual Report: Florida Growth Management Data Network Coordinating Council*, published each year since 1986, with the sixth and most recent one distributed in February, 1992. These reports are published by the Office of Planning and Budgeting, administratively located in the Executive Office of the Governor. These reports review progress during the previous year and future Council plans. The 1991 report includes a description of efforts such as development of data standards, management activities to actualize the FDSDS, and promotion of the Tampa Bay Regional Coordinating Council and other regional councils. Current efforts are concentrated on developing data standards. After five years of operation, the Council began to advance from its planning focus to an operational and implementation role in late 1990.

The Council has a Staff Advisory Committee that was selected by the members of the Council. This committee prepares recommendations and

conducts much of the work for the council. The committee includes more than one state agency representative (as recommended by council members), but each agency has only one voting member on the committee, similar to the makeup of the Council. Current activities include implementation of the FDSDS and the Data Directory. The committee is also establishing subcommittees to address specific policy issues, and is establishing and prioritizing Consensus Groups to address individual categories of data. Current work includes determining priorities for data, based on current available data or on data that has not yet been available in digital form. Efforts also include researching and documenting the cost, impact, and staffing and training requirements associated with GIS. The committee is chaired by the Council's Staff Director.

One of the main accomplishments of the Council and committee during 1990 was the Council's testing and subsequent approval of the Florida Digital Spatial DataBase System (FDSDS). It is a federation and a decentralized network of independently held and maintained databases that are linked together by standards and a management structure, through five elements of connectivity:

- Interagency cooperation and agreement;
- Collaborative development and use of an automated index of growth management data, known as the Florida Digital Spatial Data Directory, and an electronic bulletin board for interagency communication;
- Adoption of procedures to develop common data quality, accuracy and content standards for sets of data;
- Adoption of a standardized method for the exchange of spatial information;
- Adoption of common standards for geodetic control, surveying, mapping, and information systems development.

An important factor to FDSDS is that the data sets comprising the system are only those that are of multi-agency or collective value. Data sets that are unique to the responsibility of a single agency are not a part of the statewide GIS, although the Council encourages agencies to adhere to them in agency-specific data. The Council is currently implementing FDSDS.

Key to the Spatial Data Transfer Specifications are two documents, the *Quality and Accuracy Report* and the *Data Dictionary*. Each provide documentation elements necessary for GIS use. The Quality Report describes the reliability of the data, and also provides historic documentation of the data, positional accuracy, attribute accuracy assessment, a description of the logical consistency or relationships in data structures, and complete-

ness of the mapping of the objects represented.

The *Florida Spatial Data Directory* (FSDD) is being developed as an automated index of spatial data about Florida and other information available from federal, state, regional and local agencies, particularly data sets maintained by the FDSDS. The directory provides users with detailed information about data elements used in the system. FSDD is being designed to serve as a basis for identifying spatial data by category and source, and it provides a contact person when users attempt to acquire the data. It will be available online through modem access via the state telephone system, as well as in hard copy and disk versions. It is also designed to have data auditing capabilities. The directory is being developed by the Council and committee, with implementation and maintenance conducted by the Office of Planning and Budgeting in the Executive Office of the Governor.

According to the agreement, Council agencies are required to actively support the directory to ensure sharing of data and reducing data duplication. The directory will be institutionalized for use by each of the council's agencies, and the agreement specifies that agencies will participate in the creation of data definitions, as well as updating and using the directory. A categorization schema has been developed that includes 33 categories (each with subcategories). Consensus work groups will identify and collect information to be placed in the directory (see below).

During 1990 the directory was field tested when a draft manual prepared for users. Screens were developed and introduced as part of the Tampa Bay Regional Coordinating Council's work (see below, Regional and Local Government Relations and Programs). Training sessions which began in the fall of 1990 are continuing. An automated survey form will be refined and distributed to gather data. The current goal is to develop a guide for the directory in addition to the directory development itself, although funds have been limited for the directory effort.

Florida has adopted a "consensus methodology" to help meet its focus on the development of digital data and standards for multi-agency needs. The Staff Advisory Committee's Consensus Groups are designed as interim working committees which address individual data layers that will be included in the Spatial Data Directory. The groups will recommend content, format and standard for data; facilitate exchange of information and transfer of data; and coordinate collection and development of spatial data to minimize duplication of effort whenever practical and economical. The groups will also set priorities for data set needs and determine functional data sets and categories,

attribute requirements, data development methods, data resolution or scale, geo-referencing requirements, data development cost parameters, and data transfer methodology. Membership is open to any knowledgeable individuals within state, federal, regional or local agencies and other interested organizations. A pilot test of the consensus methodology was successfully tested as part of the Coastal Zone Management Project in the Tampa Bay region for soils data (see below). The first consensus group is being established for soils data work. Other consensus groups will be developed in the future.

Florida is one of the few states in the nation that has initiated and completed a high-precision geodetic network.

Subcommittees of the Advisory Committee are also under development. For example, the Public Records Law Subcommittee was recently initiated, and has just begun investigation of related issues. The Aerial Photography Subcommittee, with participation by DNR and others, is conducting an inventory of available photography and is developing recommended procedures for acquiring aerial photography. It is also conducting a needs assessment of individual entities to determine common needs which exist in the state. From this effort, it is expected that cooperative efforts and agreements will evolve to develop additional aerial photography in order to meet Florida needs.

The Global Positioning Systems Subcommittee (GPS) is evaluating the cost effectiveness of using GPS technology in Florida. A variety of state agencies are using or considering use of GPS. In addition to this subcommittee, Florida also has a GPS Users Group.

The subcommittee is evaluating how fixed monitoring sites will be helpful, and is considering applying for grants from NASA and the Emergency Highway Safety to help establish sites. The sites would assist in using GPS technology more effectively and result in more accurate information. Some of the anticipated uses are to help evaluate where accidents are taking place, assist in the delivery of emergency services, help define habitat boundaries, assist in research on geologic movement, and help rectify aerial photography. In addition, the fixed sites would assist by significantly reducing manpower.

Subcommittee plans include conducting a needs assessment that would conduct surveys of each state agency to determine current methodologies for site locations, and to determine if GPS tech-

nology may be a cost-effective alternative. A project to evaluate the use of fixed monitoring stations for controlled aerial photography is being considered, and if approved will be conducted with the Aerial Photography Subcommittee. A plan for a pilot project is also being considered.

Florida is one of the few states in the nation that has initiated and completed a high-precision geodetic network. Using the radio signals of the Department of Defense's NAVSTAR (Navigation Satellite Time and Ranging) GPS system, this survey establishes a horizontal reference network utilizing GPS, and is accurate to eight millimeters (+/- 1 part per million), while maintaining or preserving the integrity of the National Geodetic Reference System (NGRS). Reconnaissance, observations, data reduction, and adjustments have been completed. The project was undertaken by the National Geodetic Survey (NGS) of the National Oceanic and Atmospheric Administration, the Department of Natural Resources, the Department of Transportation's Bureau of Aviation, and the Federal Aviation Administration. The University of Florida processed the data for educational purposes. The intent of the survey was to upgrade the existing NGRS by establishing a high-precision framework of GPS determined points tied to the existing horizontal North American Datum of 1983 and the National Geodetic Vertical Datum of 1929. Efforts are underway to further increase the density of the network to a 15-mile grid, and to continue working with the counties to establish a three-mile grid to assist in GIS use.

The Cooperative Base Mapping Initiative Subcommittee is working to promote the development of a standard base map for the state. The majority of this subcommittee's efforts have concerned the development of updated hard copy and digital versions of the 7.5 minute quadrangle maps in coordination with the USGS.

During the 1990 budget request process the Information Resources Commission (IRC) became aware of similar digital base data needs among various state agencies. It then facilitated correspondence between the Department of Agriculture and Consumer Services' (DASC) Agriculture Management Information Center, the Department of Environmental Regulation (DER)'s Division of Administrative Direction and Support Services, and the Department of Natural Resources' (DNR) Division of State Lands. The three agencies had various meetings with the USGS, and it was agreed that each would request funds totalling \$1,050,000 to participate in a Joint Funding Agreement (JFA) with USGS. DNR also committed to using \$150,000 of its base funds which helped result in a \$1.2 million state initiative.

The goal of the effort was defined as the development of a statewide digital base map at the 1:24,000 scale within five years. It would include updating all of Florida's 1,050 manual 7.5 minute topographic maps, as of 1980, and developing digital data meeting USGS standards. Data to be included would be everything available on the quadrangle maps including contours (hypsography), and the quadrangles would be edgematched to facilitate usage. The project was also designed to include bathymetry for coastal areas in coordination with the National Oceanic and Atmospheric Administration (NOAA). The project would include evaluation and potential use of available base and digital data from a variety of sources. For example, DOT's existing digital data and aerial photography, and DER and the Water Management Districts's digital data development efforts work would also be evaluated for potential use.

The Governor's Budget Recommendations for FY 1991-93 included DER's request for \$400,000 to participate in the project and an additional \$302,000 for GIS activities, but they did not recommend requested project funds for DACS and DNR. Accordingly, Legislative Budget Requests included requests for all three agencies. To support this data development many efforts were made by the Council and by state agencies to convince the Legislature to fund additional contributions to the multi-agency base mapping effort, including letters and attendance and testimony at legislative hearings. These efforts helped encourage the legislature to fund the request for DER and DNR in the spring of 1991, but the request by DACS was not approved.

With approval of \$800,000 to proceed, efforts to begin the project and to finalize the JFA accelerated, and plans were made to complete the work by 1993. According to the JFA provisions, USGS will archive and update the data. A new Cartographic Advisor position will be established. This position will be half-funded by U.S. Fish and Wildlife Service, including 25% from USGS, and 25% from state government's funds for the project. The Cartographic Advisor will serve as a coordinator for the JFA with USGS, and will work with FWS on updating the National Wetlands Inventory.

Efforts are underway to determine which additional agencies might participate in co-funding the project in the future. Trust funds available from permits and fees, such as the Air Pollution Control Fund, Water Quality Assurance Fund, and the Inland Protection Trust Fund are being considered. Other agencies are also being contacted and asked to contribute to the project.

An additional group under development is the Florida Base Mapping Advisory Committee (BMAC) created by Executive Order. BMAC was informally organized in 1990 to serve as a technical advisory committee for both manual and digital mapping. Its focus is on helping to develop a geodetic base map; multipurpose planimetric maps which display information on transportation, hydrography, the Public Land Survey System and political boundaries, and a multipurpose cadastral (parcel) map which includes property ownership, parcel boundaries, easements, and other categories that are used by local governments for property appraisal and tax assessment. Participants in BMAC include technical-level representatives, such as surveyors and cartographers from state, regional and local agencies, as well as from private entities in Florida. Surveying faculty at University of Florida at Gainesville, is BMAC's interim chair. It is envisioned that BMAC will make recommendations to the Growth Management Data Network Coordinating Council and others on ways to achieve quality mapping for the state, including making recommendations to USGS regarding topographic mapping needs. Bylaws have been drafted for BMAC.

In addition to these groups, Florida is an active participant in the Gulf of Mexico Program along with other Gulf of Mexico states and the U.S. Environmental Protection Agency. Florida representatives participate in the Program's Data Information Transfer Subcommittee.

Regional and Local Government Relations and Programs

The *Local Government Comprehensive Planning and Land Development Regulation Act of 1985* was adopted to accommodate growth with a program of local planning and policies encouraging compact urban expansion, restrictions on coastal development, and the requirement that infrastructure be in place at the same time as development. The act provides state government with a strong voice in local activities, and the Department of Community Affairs (DCA) is authorized to review and approve local land use plans. A checklist of criteria is used to evaluate each plan, including that the infrastructure must be available to meet each local government's existing and specified level of service for roads, water, wastewater, solid waste, drainage, and parks and recreation.

The five Water Management Districts are developing much of Florida's use of GIS and digital data. For example, the South Florida Water Management District began use of automated mapping beginning in 1977. All of the districts are using GIS software and are members of the Water Management Districts GIS coordinating group. DER has provided some funding to accomplish

this data development work, and it requires the districts to share their data with DER.

One of the Growth Management Data Network Coordinating Council's major efforts in 1990 was the regional pilot project involving state, regional and local agencies which defined comprehensive system requirements for a coastal zone management GIS. This effort was described in the December, 1990 report entitled *A Model GIS for Coastal Zone Management (CZM)*. The project was initiated by the Governor's Office with funding provided by NOAA's CZM Program of developing a model a multi-agency for GIS in the Tampa Bay region that included DNR, DER, DCA, the Tampa Bay Regional Council, the Southwest Florida Water Management District, and Hillsborough, Manatee and Pinellas Counties. This pilot project was initiated as an effort to promote information sharing, develop procedures to avoid duplication of data collection, promote methods for developing consistency of data elements, and develop procedures for adopting common data formats for multi-agency/governmental sharing of data.

Current efforts resulting from this project include development of a Regional Growth Management Coordinating Council in the Tampa Bay Region. This regional council will have the same goals as the state Council, including cooperative development of data standards and facilitating cooperative activities. During 1990, a written survey was conducted of all governmental units in the region, including five federal agencies, six regional entities, and various departments of four counties, in order to develop a description of data available in the region. Through the project's work, data sharing efforts and methods were discovered, and a review of technical issues and solutions was prepared. The project enabled agencies to work together to develop and test a consensus group methodology using the U.S. Soil Conservation Service's soil survey (see above).

In addition to these efforts, a recommended regional management structure was developed and is being introduced to the region. The recommended structure for the Regional Coordinating Council includes four bodies. The Regional Council consists of the chief executives of members agencies; the Regional Advisory Committee consists of staff members of these agencies and others as recommended; the Central Information Unit is an autonomous body that will act as a facilitator; and the Consensus Groups are the primary working bodies of the effort. The Executive Director of the Tampa Bay Regional Planning Council is expected to serve as the chair of the council. A memorandum of understanding has been signed

by leaders of state agencies, regional entities, and counties in the region in 1992. NOAA has agreed to provide funding for one staff person for a year to develop the regional network. The Florida Spatial Data Directory will be introduced as part of the Regional Council's work, and an automated survey will be used in the region to complete the directory. The Tampa effort is considered to be a pilot for other regions in the state, and efforts will be underway to promote the development of similar programs throughout the state.

Policies/Standards

State legislation which created the Council in 1985 authorized it to establish policies and standards. It then established an agreement and framework to develop and implement them. The November, 1990 agreement authorizes the Florida Digital Spatial DataBase System (FDSDS), the use of the Federal Spatial Data Transfer Specifications (SDTS), the Florida Spatial Data Dictionary, and establishes 16 standards providing guidance to agencies developing GIS.

The SDTS provides that all data sets in FDSDS will follow the Federal Spatial Data Transfer Specifications currently proposed and expected to be established by the National Institute of Standards and Technology (NIST) as a federal standard. The agreement provides that Informal Transfer methods can be used when appropriate.

The Florida Spatial Data Directory is an automated catalog of information about what spatial data exists in the state. It is maintained by the Office of Planning and Budgeting and includes standard data assessment, documentation, and reporting templates, including "Quality" and "Accuracy" reports.

Standards related to GIS are specified in the agreement. It states that "agencies shall adhere to the following standards in the execution of tasks pertaining to planning, geodetic referencing, surveying, mapping and base map development for GIS." These standards include planning requirements for GIS development; eight are specific standards to guide the development of a geodetic reference framework, and another seven cover land-parcel mapping, surveying and base maps (see **Documents Excerpts**).

Standards efforts underway in 1991 include working with individual council agencies to establish procedures to promote compliance with standards recommended by the council. The Data Dictionary and the Quality and Accuracy Report templates that were tested as part of the Coastal Zone Management Project will be tested as well by state agencies.

GIS in State Government

The **Office of Planning and Budgeting** (OPB) in the Executive Office of the Governor is the lead coordinating agency for geographic information and GIS in Florida. It acts as chair and staffs the Florida Growth Management Data Network Coordinating Council, in accordance with the Growth Management Act of 1985. The OPB Staff Director is the staff for the Council and chairs the Staff Advisory Committee. OPB funding supports this position.

OPB is focusing its efforts on data coordination and development, and currently is not a direct user of GIS technology. Its primary efforts are concentrated on supporting the council's data management efforts, including development of the Florida Digital Spatial DataBase System, the Spatial Data Directory, forming consensus groups to address data and related standards needs, and support the development of Regional Coordinating Councils. It serves as the lead for the Tampa Bay Regional Coordinating Council with funding provided by NOAA's Coastal Zone Management (CZM) Program (see **Coordination Efforts, Groups and Activities**).

In coordination with other agencies, OPB is the state administrator for the Coastal Ocean Management, Planning and Assessment System (COMPAS), which is a microcomputer-based information system being developed for the nation's coastal states by NOAA. The objectives of the system are to bring existing but disparate coastal resource information into a singly user friendly environment; simplify the transfer of data from state-level decision makers and the federal government; and to make it easier to apply large data sets in new and innovative ways toward problem solving and conflict resolution. The system operates on a Macintosh personal computer using Hypercard software. A prototype was developed which includes National Estuarine inventory data. Data can be output as tabular data, bar or pie charts, and as maps of the locations of various conditions, including wetland permits and point source discharge permits. Analytical and predictive modeling such as pollution discharge models are under development. Applications include meeting Clean Water Act reporting requirements, evaluating National Estuary Program estuaries, identifying impacts of wetland permitting, and others. COMPAS efforts are focusing on improving decision making capabilities, particularly at the state level.

Florida's **Information Resources Commission** (IRC) was created by the legislature in 1983. It was charged with leading and providing statewide direction for information resources management (IRM), including all information technology, policy, and planning throughout state government. Accordingly, the IRC is focusing its primary efforts on planning and budgeting for information technology. Its role includes developing the state Strategic Plan for IRM every other year, as well as having oversight responsibilities over related agency activities, including review and approval authority over agency IRM plans and budgets. While having a strong policy and planning role and responsibility, IRC does not provide any central data processing or telecommunications services, and its staff and resources have been reduced because of the state's financial crisis.

The **Department of General Services'** (DGS) Administrative Management Information Center has a central data processing center which provides mainframe services to agencies. Its Division of Communications is responsible for Florida's state telecommunications services. IRC and DGS are ex-officio members of the Growth Management Data Network Coordinating Council. DGS focus is on telecommunication efforts, among other functional communication efforts.

As part of its agency oversight role, IRC staff reviews all GIS proposals in order to determine their consistency with state IRM direction. As part of its role with the Council and as an effort to promote the development of common geographic databases that will have multi-agency utility, IRC staff initiated meetings to bring state agencies together to develop a state digital base map at the 1:24,000 scale (see **Coordination Efforts, Groups and Activities**). The IRC does not dedicate any staff or other resources specifically for geographic information, but it actively participates in the Council's coordinating efforts.

Florida has two main agencies addressing natural resources and environmental needs in the state, the **Department of Natural Resources** (DNR) and the **Department of Environmental Regulation** (DER). DNR is a decentralized agency with various district offices including marine and land resources programs. DNR has implemented a strategic planning process to develop future agency goals. Of its 22 adopted goals, data management and GIS were selected as the top agency priorities since most of DNR's data can be referenced by location. DNR works cooperatively with DER, particularly since both agencies are members of the Growth Management Data Network Coordinating Council. DNR committed \$150,000 of its base funding for FY 1991-93 to develop a statewide digital base map for Florida, and was successful

in acquiring \$250,000 in additional funds from the legislature so that \$400,000 has been allocated by DNR for this statewide effort (see **Coordination Efforts, Groups and Activities**).

DNR's Division of Administration includes the **Bureau of Management Systems and Services**, which is helping to develop a department-wide approach to geographic information and GIS. DNR does not have a centralized GIS facility; GIS efforts are currently conducted by individual divisions. The Office of Marine Programs and Planning and the Office of Land Use Planning and Biological Services are helping to develop a department-wide approach to managing geographic data and GIS.

The **Division of Marine Resources' Marine Resources Institute** in St. Petersburg is currently the largest user of GIS in DNR (and therefore also in state government). It has nine staff members working full-time on the division's GIS efforts, which is termed the Marine Resources GIS (MRGIS). Four of these staff positions were added in July, 1991. Funds from the Coastal Protection Trust Fund and the Salt Water Fishing Licensing Fund are used for approximately 75% of the division's GIS efforts, with federal funding support from the National Oceanic and Atmospheric Administration's (NOAA) Coastal Zone Management Program via the Florida DER and the U.S. Fish and Wildlife Service (FWS).

FWS is funding three positions to develop the recreational fisheries component of MRGIS's database for this year. In the past, the Division has worked with FWS regarding the National Wetlands Inventory data and the National Wetland Research Center for digital data development. FWS is also funding half of the personnel costs for the State Cartographer position to be established in 1991, with the other half of the funding provided by USGS and state government as part of the efforts to build a state digital base map (see **Coordination Efforts, Groups and Activities**). Its current annual budget is approximately \$1 million. The Marine Institute is using a SUN server with six SPARC workstations and five personal computers that all exist on one network. Software used includes ARC/INFO, pcARC/INFO, ERDAS, and ELAS.

Since implementation of MRGIS, the Institute has developed a base inventory on the Florida's Marine and Estuarine Fisheries Habitat, and has also developed trend analyses for fisheries habitat for over a 50-year period. This work was conducted in cooperation with DOT. Automation of the oil spill sensitivity atlas has been accomplished, and future efforts will be conducted for the Florida Keys Marine Sanctuary. In addition to this work, the division's Tallahassee office is using GIS

to monitor endangered species to manage manatees in Florida. There is one staff member working on this effort. The Institute is joined in the project by the Governor's Office and the Growth Management Data Network Coordinating Council, resulting in a *Model GIS for Coastal Zone Management* in the Tampa Bay area (see **Coordination Efforts, Groups and Activities**, Regional and Local Government Relations and Programs).

DNR's **Division of State Lands** is responsible for managing over 20 million acres of state land contained in approximately 11,000 parcels. The division's responsibility increased in 1990 when the State Legislature adopted the Florida Preservation 2000 Act. This act was adopted because of the belief that "imminent development of Florida's remaining natural areas and continuing increases in land values necessitate an aggressive program of public land acquisition . . . to preserve the quality of life that attracts so many people to Florida." The act provides that "acquisition of public lands should be based on a comprehensive assessment of Florida's natural resources so as to protect the integrity of ecological systems and to provide multiple benefits, including preservation of fish and wildlife habitat, recreation space, and water recharge areas." Accordingly, the act provides for bonds to be issued that would provide up to \$300 million per year for up to 10 years. These funds will be used primarily by DNR and the Department of Environmental Regulation (DER) to purchase lands for preservation and recreation. Previously, DNR spent approximately \$40 million per year on land acquisition, and the act increases the division's level of effort significantly.

The act further provides that DNR develop an implementation plan for a statewide public lands GIS, as well as an "ongoing computerized information systems program to modernize its state lands records." The department asked a multi-agency committee to develop an outline of the data needs for a proactive land acquisition project. It was determined that an effort could be undertaken at the 1:100,000 scale in an effort to identify additional properties for acquisition, since many of the selected lands have already been determined.

Efforts have begun to meet this directive, and it is now one of the largest initiatives in the division. The division is focusing its initial efforts on data management, and thus far does not have any GIS technology. Funding for this project is approximately \$1.2 million a year. The first phase of the project involves the conversion of all paper land record documents to optical disk format using scanning technology. The act stipulates that DNR is to continue the development of this state lands document imaging and retrieval system. These records are all being geographically refer-

enced so that they can be used with GIS. Funding for this project is approximately \$1.2 million a year.

Efforts are also underway to improve Florida's aerial photography resources and geodetic referencing, and this includes active participation by the Council subcommittees working on these needs (see **Coordination Efforts, Groups and Activities**). Additional phases of the project will include processing this data within the lands management database in order to link the locational information with land use documents to produce a revenue component and to produce the state lands ownership digital maps.

The third phase of the project is the mapping component. The division's Bureau of Surveying and Mapping is an active participant in relevant Florida efforts. The division maintains the office of the state's Geodetic Advisor, co-chair of the GPS Subcommittee. It is expected that the division will take an active role in related statewide standards as part of its efforts to comply with the Preservation 2000 Act.

DNR's **Division of Beaches and Shores** is an active user of geographic information, including GIS and GPS. It has a two-person staff working full-time with GIS as part of a \$500,000 pilot project jointly-sponsored by the division and the U.S. Army Corps of Engineers that evaluates beach management in Broward and Dade Counties. To accomplish this task, DNR is developing high resolution data. Efforts are underway to establish geodetic control for the coastal set back-line. If monuments are destroyed, GPS positioning can allow for easy relocation at the correct positions. The division is also using GPS to conduct hydrographic surveys. Future plans call for connecting all tide gage stations to the horizontal network, and the division continues to develop its capability to convert data into GIS format.

Other state divisions have used automated geographic information and related technologies, but to a more limited extent than most of those discussed above. The **Division of Resource Management**'s Bureau of Aquatic Plant Control is using LANDSAT imagery with one full-time technician in order to monitor encroachment of plants in the state's lakes. The **Bureau of Mine Reclamation** is using an Intergraph workstation linked to Florida Resource and Environmental Analysis Center (FREAC) located at Florida State University. It is used to monitor the mining and reclamation process. The **Division of Recreation and Parks** has used pcARC/INFO for special projects, including a rivers study.

The **Department of Environmental Regulation** (DER) is responsible for the regulation, protection and management of Florida's environmental

resources. Supplementing the work performed by Florida's DNR, the responsibilities of DER concern man-made influences on the environment. It has four program divisions, including Air Resources Management, Water Facilities, Water Management, and Waste Management.

DER has had a department-wide approach to geographic information and GIS since 1988, coordinated through its Comprehensive Land and Environmental Analysis Network (CLEAN). Its Division of Administrative and Technical Services includes the Bureau of Information Systems (BIS). A "GIS Section" was created in BIS in October, 1988. A department-wide needs assessment was conducted in-house at that time, followed by the careful selection of hardware and software.

The Department of Environmental Regulation has established data goals based on its needs assessment, which is frequently updated. In time, high-level managers will increasingly prioritize data development purchasing, and accordingly these managers are part of the decision making process.

The department has concentrated on the development of data to meet agency missions and functions. DER has established data goals based on its needs assessment, which is frequently updated. In time, high-level managers will increasingly prioritize data development and purchasing, and accordingly these managers are part of the decision making process. In this way, budget requests for data used in GIS also originate from program staff and agency leaders rather than solely from the GIS staff.

DER works cooperatively with DNR regarding geographic information, especially because both agencies are members of the Growth Management Data Network Coordinating Council. DER successfully requested funding of \$400,000 for FY 1991-93 through the governor's and legislature's budget request process to contribute these funds to the statewide effort to develop a statewide digital base map (see **Coordination Efforts, Groups and Activities**). DNR and DER are jointly responsible for NOAA's Coastal Zone Management (CZM) Program, and are working together with the Governor's Office on the Tampa Bay CZM pilot project.

DER has spent approximately \$1 million per year on GIS since initiation, and expects to continue to allocate that amount in future years. The

funds are used for data development and hardware and software support. Approximately 60% of DER's GIS funding is from trust funds, including the Air Pollution Control Fund, the Water Quality Assurance Fund, and the Inland Protection Trust Fund, with support from permits and fees. The remaining 40% is from U.S. EPA. Four positions were originally allocated to the section, and there is now the equivalent of 5.5 staff members working on GIS, including a remote sensing specialist. There is no other staff dedicated to GIS in DER, although some program staff spend almost all of their time with GIS. The section also serves as a consulting bureau for the divisions.

Mainframe administrative computer services are provided by the Department of General Services. DER has VAX 6410 and 6420 computers for GIS, and scientific computing and office automation applications, which includes ARC/INFO and ORACLE software for GIS use. A workstation was at one time connected to FREAC's Intergraph system at Florida State University, but was disconnected in July, 1991. ERDAS software was recently acquired. The system is supported by an Ethernet network, and all four divisions are connected to the VAX cluster. Plans are to add additional hardware and software in the GIS section.

DER funded much of Florida's initial digital data development, which includes USGS maps and DLG files at the 1:24,000 scale. DER has supported data development efforts in some of the Water Management Districts, and is participating with them to enhance data. DER works with various agencies to develop and access thematic data. Of significance is the fact that DER's tabular data has maintained geographic coordinates (such as latitude and longitude or UTM coordinates) for over 15 years, and this referencing is expected to greatly increase its usefulness with GIS. Some U.S. EPA funds will be used for GPS to verify these locations. While U.S. EPA's Location Data Policy has a locational accuracy of 25 meters, it is planned that DER's data will meet National Map Accuracy Standards, accurate to 40 or 50 feet.

The **Division of Water Management** the largest user of GIS in DER. The Bureau of Surface Water Management includes GIS as a part of its daily work for the production of surface water quality assessment reports submitted to U.S. EPA. It is in the process of automating the storm water runoff assessment and integrating it with U.S. EPA's 305B report and point source surface water quality assessment. The bureau is working with the Water Management Districts, including providing some funds for data development. The districts are required to share their data with DER, which purchased ERDAS software to help process the data. The Bureau of Wetland Resource Man-

agement is using GIS to conduct a jurisdictional evaluation using National Wetlands Inventory data to determine which waters belong to the state.

The **Division of Water Facilities**' major applications have been in the Bureau of Groundwater. It is producing maps of potential groundwater contamination areas which affects new well construction characteristics. As of 1988, Florida statutes require that applicants for wells must show where pollution might occur, and it prevents impact to the aquifer. In addition, before approval of a well permit, applicants must conduct any analyses that DER requires. Proximity analyses are being conducted, and efforts are underway to use leaking underground storage tank data with GIS.

The **Division of Air Resources** is in the process of loading air emissions data and air monitoring sites into the system. A pilot project is underway to ensure that air monitoring sites are in the proper locations to monitor air conditions. Plans are to use meteorological data to develop appropriate models for air pollution, including hazardous waste incinerators.

The **Division of Waste Management** is using GIS with a modeling system in the emergency response section to evaluate the potential use of chemical dispersant on oil spills.

The **Game and Fresh Water Fish Commission**'s Office of Environmental Services began development of a comprehensive Statewide Wildlife Habitat System in the mid-1980s. The system was designed for non-game wildlife habitat mapping and modeling, including determination of the habitat requirements of priority wildlife species. The habitat data was under development with the Department of Natural Resources and contracted by the Department of Transportation. A raster-based digital habitat map was completed with individual planning council regions using an unsupervised classification of LANDSAT multi-spectral data. Individual classes were identified with 22 land cover types using 1:24,000 scale black and white photography. Seven to ten percent of the data was groundtruthed. A major use of the data and system is the identification of lands that can be purchased to protect habitat. Additional data development efforts include in-house digitizing of public lands boundaries, using a variety of source maps. This information is being used to create a map of the state by July 1992, which will show prioritized lands that should be purchased through Florida's Preservation 2000 efforts (see DNR).

The office has three full-time staff members using GIS, with annual expenditures of \$230,000. Expenditures for the commission's data development efforts to date have been over \$1 million. Funding has been provided by the Nongame Wildlife Trust Fund. The commission has three 386

workstations with SPANS software for GIS use, and Delta Data Systems ATLAS image processing software.

The **Department of Agriculture and Consumer Services'** Agricultural Management Information Center began development of an agency-wide approach to GIS in 1988. It is using SUN workstations with ARC/INFO and ERDAS to interpret and map habitats for endangered species and to protect groundwater resources from pesticide contamination. This effort is funded through an U.S. EPA grant. Groundwater protection efforts are being conducted with the University of Florida in northwest Florida.

The **Department of Transportation** (DOT) has been actively involved in automated geographic information development with other agencies for many years. Its Transportation Statistics Office initiated GIS efforts in the agency. It is using a microVAX 3300 minicomputer and VAXstation 3100 workstations, with McDonnell Douglas and Oracle software for its Traffic and Roadway Characteristics Reporting project. Its first application was the development of highway system maps with a base scale of 1:24,000. Evaluation of this digital data is underway for potential statewide use. DOT is using an Intergraph system for CAD applications. DOT has an aerial photography program, and makes this available to the Department of Revenue as a way to assist counties in property tax efforts. DOT also contributed to the state's geodetic network with other state agencies (see **Coordination Efforts, Groups and Activities**, Global Positioning Systems Subcommittee).

Other agencies are also beginning use of GIS technology. The Environmental Epidemiology Division of the **Department of Health and Rehabilitative Services** is using a VAX with Intergraph for thematic mapping for some groundwater evaluation work. The **Department of Community Affairs** (DCA) is responsible for working with communities regarding land use planning efforts, and is actively involved in Florida's Growth Management efforts (see **Coordination Efforts, Groups and Activities**, Regional and Local Government Relations and Assistance). It has also been involved in efforts to map and monitor land use with LANDSAT satellite imagery. It is currently using pcARC/INFO and ATLAS*Graphics with Census Bureau TIGER files.

Legislative Activities

The **Florida Senate Committee on Reapportionment** is developing a redistricting system with two SUN servers and eight SUN workstations using ARC/INFO software. The **Florida House Committee on Reapportionment** is using a contractor's services for redistricting support.

The Florida **Land Acquisition Advisory Council** is participating in the Florida Preservation 2000 Act, which provides that Florida State University's Florida Resource and Environmental Analysis Center (FREAC) "develop a plan for a statewide public lands GIS." It directed that the plan include an inventory of existing GIS within state agencies, universities and water management districts. This March, 1991 report entitled *A Plan for a Statewide Public Lands GIS*, includes recommendations for the development of such a system (see Department of Natural Resources).

Academic Activities

Florida's universities are using GIS for a variety of purposes. The legislature's Florida Preservation 2000 Act provides that the Florida Resource and Environmental Analysis Center (FREAC) at **Florida State University**'s (FSU) Institute of Science and Public Affairs develop a plan for public lands GIS, resulting in their March, 1991 report entitled *A Plan for a Statewide Public Lands GIS*. FREAC currently acts as a GIS service center, in addition to other functions. It has been used by some state agencies for GIS work. FSU's Department of Geography also has GIS facilities and provides some classes in this subject.

Other universities also have GIS activities underway. The **University of Florida**'s Departments of Geography and Urban Affairs are each conducting classes and have laboratory facilities. It also has a surveying program, and a member of its faculty is one of the primary leaders behind the initiative to establish a Base Mapping Advisory Committee in Florida (see **Coordination Efforts, Groups and Activities**). In addition, the **University of South Florida** offers course work in GIS at the graduate level, and is increasing its GIS program and facilities. Other universities and community colleges are developing classes in GIS, such as **Florida Atlantic University**'s Geography Department.

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Documents List

Memorandum of Understanding

Florida Growth Management Data Network Coordinating Council Interagency Agreement, September 1, 1989, amended October 12, 1990.

This agreement specifies how the members of the Growth Management Data Network Coordinating Council "shall implement the conditions specified in Florida Statutes s. 282.403" adopted in 1985. It states that the parties to the agreement, "have determined that geographic or spatial data is essential for effective interagency and intergovernmental management of Florida's growth

... and GIS are the focus and framework for the execution of this agreement." It includes four pages on definitions, and includes the following terms:

1. Florida Digital Spatial Data Base System and Management Structure

"Agencies shall work together to create a system of independently operated and maintained digital spatial databases that meet the standards set forth in the terms of this agreement." It encourages minimal standards for all agencies to follow, and encourages each to give "management priority and support" to "work necessary for reaching consensus about agency responsibility for growth management data development, maintenance and exchange."

2. Formal Spatial Data Transfer Specifications

All data sets in the Florida Digital Spatial Data Base System will follow the federal Spatial Data Transfer Specifications (SDTS) expected to be established by the USGS and NIST. These state that all data sets in the Florida Digital Spatial Database System will have a data dictionary to convey the meaning and relationship between entities and attributes, and a data quality assessment report with comments about lineage, positional accuracy, attribute accuracy, logical consistency and completeness.

3. Informal Spatial Data Transfer

When use of SDTS is not possible or appropriate, spatial data transfer can occur through the use of AUTOCAD DXF, DLG, or band interleaved by line (or band sequential by line) for raster data.

4. Florida Spatial Data Directory

The directory is an automated index under development which will be maintained by the Office of Planning and Budgeting. It will be continually updated and supported by all participating agencies as defined in the agreement.

5. Standards for GIS

Sixteen standards related to GIS are specified in the agreement. It states that "agencies shall adhere to the following standards in the execution of tasks pertaining to planning, geodetic referencing, surveying, mapping and base map development for GIS." These standards include planning requirements for GIS development; eight standards guide the development of a geodetic reference framework, and another seven cover land-parcel mapping, surveying and base maps (see **Documents Excerpts**).

Publications/Reports

Annual Report: Florida Growth Management Data Network Coordinating Council, Office of Planning and Budgeting, Executive Office of the Governor, February 1, 1991. (Fifth annual report)

This document reviews progress in 1990 and the

future plans of the Growth Management Data Network Coordinating Council. It describes the Florida Digital Spatial DataBase System (FDSDS), which is a decentralized network of independently operated and maintained digital spatial databases that form a "system" through interagency cooperation and agreement. The report also includes procedures adopted to develop common data quality, accuracy and content standards for sets of data. It describes collaborative development and use of an automated index of growth management data, the Florida Digital Spatial Data Directory, and an electronic bulletin board for interagency communication. A standardized method for the exchange of spatial information was adopted and is described, as well as common standards for geodetic control, surveying, mapping, and information systems development.

Accomplishments during 1990 explained in the report include the Council's approval and testing of the FDSDS; completion of the project resulting in *A Model GIS for Coastal Zone Management*; development and promotion of legislation and funding to support the multi-agency base mapping effort; planning for the creation of a Florida Base Mapping Advisory Committee; development of a Regional Coordinating Council in the Tampa Bay Region; creation of a formal procedure for developing standards for specific sets of data; and coordination of data sharing between the state, the U.S. Environmental Protection Agency, and other Gulf states through the Data Information Transfer Subcommittee of the Gulf of Mexico Program. The report includes a description of the Council's future direction and plans, including continued efforts in the progress areas, particularly the development of data standards, management activities to actualize the FDSDS, promotion of the Tampa Bay Regional Coordinating Council and other regional councils. A copy of the council's amended Interagency Agreement (as of October 12, 1990) is included in the report.

A Model GIS for Coastal Zone Management — Final Report, Executive Office of the Governor of Florida, Office of Planning and Budgeting, December, 1990.

This report describes the Coastal Zone Management Program's project that was awarded by the National Oceanic and Atmospheric Administration (NOAA) to the Florida Executive Office of the Governor to develop a model GIS in the Tampa Bay region. This pilot project involves state, regional and local agencies efforts to promote information sharing, develop procedures to avoid duplication of effort in data collection, promote methods for developing consistency of data elements, and develop procedures for adopting com-

mon data formats for multi-agency/governmental sharing of data. The report includes a description of data available in the region, discussion of data sharing efforts and methods, review of technical issues and solutions, development and testing of a consensus group methodology using the U.S. Soil Conservation Service's soil series, description of a regional management structure which has been developed and is being introduced into the region, and a statement of future needs. A written survey was conducted with all governmental units in the region, including five federal agencies, six regional entities, and the departments of four counties. The report also includes a draft memorandum of understanding between leaders of state agencies, regional entities and counties in the region, and also presents a recommended management structure for the Regional Coordinating Council.

Annual Report: Florida Growth Management Data Network Coordinating Council, Office of Planning and Budgeting, Executive Office of the Governor, February 1, 1990 (Fourth annual report).

This document reviews the background, progress in 1989, and the future plans of the Growth Management Data Network Coordinating Council. It describes its mission of creating a decentralized network to promote "interagency transmission of growth management data." This network, called the Florida Digital Spatial DataBase System, consists of independently operated GIS applications which are linked together through interagency cooperation, common data needs and data standards, geo-referencing, and the use of a standard data transfer methodology in which "compatible computer hardware and software configurations are not required." Accomplishments during 1989 included an interagency agreement (effective September 1, 1989) to implement the Florida Digital Spatial DataBase System; an automated index of spatial information called the Florida Spatial Data Directory; draft standard templates for the transmission of Data Quality and Accuracy Reports and Data Dictionaries; proposed standards for information system development, geodetic referencing, mapping and surveying; consideration of statewide land cover mapping needs for the cooperative acquisition of remote sensing data; and consensus groups to establish priorities for data set priorities, data set attribute requirements, data development methods, data resolution or scale, geo-referencing requirements, data development cost parameters, and data transfer methodology.

Section II of the report discusses the council's future direction and plans, including the description of a pilot project involving state, regional and local agencies designed to define comprehensive

system requirements for a coastal zone management GIS. Future work involves the focus on researching and documenting the costs, impacts, and staffing and training requirements associated with GIS. A copy of the council's Interagency Agreement of September 1, 1989 is included in the report.

Strategic Directions Report, Florida Growth Management Data Network Coordinating Council, September, 1988.

This report provides a description of the "business architecture" employed for growth management, an analysis of the existing GIS environment, and various recommendations. The "business architecture" for growth management includes functional and information models for the nine agencies that are designated as growth management agencies. Identified growth management functions include the responsibility to regulate, enforce, provide services and facilities, market, assess environment and avail resources; subfunctions are identified under each function. A matrix of these functions and the agencies that perform them was used with matrices of data needs and data created by state agencies to create an information model. Tables of hardware and software for each agency were also created from the survey and analysis of agencies. Recommendations were provided based on this work and on a workshop held in May, 1988 to validate the concept and strategic direction in addition to information exchange. They included establishment of data structure and quality and accuracy standards; maintenance of a common base map and central index and directory of GIS data and sources; and formulation of a GIS organization responsible for implementing a statewide GIS, interagency information sharing agreements, and a GIS users group.

A Plan for a Statewide Public Lands GIS, Presented to the President of the Senate, the Speaker of the House of Representatives and the Land Acquisition Advisory Council, Florida State University, Florida Resources and Environmental Analysis Center, March 1, 1991.

This report provides a description of a proposed statewide public lands GIS that could be implemented to help meet the needs of Preservation 2000, an act passed by the legislature in 1990. The act specifies that such a system should be implemented. The report includes a description of the scope, objectives and need for such a system; hardware and software approaches; implementation strategy; components of the system including data needs; a timetable and implementation plan; and a work plan for phase one of this effort.

Paper

Florida's High Precision Geodetic Network, Taylor, Ronnie, National Geodetic Survey, National

Oceanic and Atmospheric Administration, 1990.

This paper describes how the State of Florida completed a GPS survey, based on observations of the radio signals of the Department of Defense's NAVSTAR (Navigation Satellite Time and Ranging) GPS system. This survey establishes a horizontal reference network, utilizing GPS, and is accurate to eight millimeters (+/-1 part per million), while maintaining or preserving the integrity of the National Geodetic Reference System (NGRS). Reconnaissance, observations, data reduction, and adjustments have been completed. The project was undertaken by the National Geodetic Survey (NGS) of the National Oceanic and

Atmospheric Administration, Department of Natural Resources, the Department of Transportation's Bureau of Aviation, and the Federal Aviation Administration. The University of Florida processed the data for educational purposes. The intent of the survey was to upgrade the existing NGRS by establishing a high-precision framework of GPS-determined points tied to the existing horizontal North American Datum of 1983 and the National Geodetic Vertical Datum of 1929. The paper also summarizes the general NGS policy related to upgrading the NGRS and NGS's policy statement regarding state high-precision networks.

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Document Excerpts

GROWTH MANAGEMENT DATA NETWORK COORDINATING COUNCIL AMENDED INTERAGENCY AGREEMENT

Article I—Statement of Purpose

This Interagency Agreement is amended as follows to finalize the proposed standards as set forth in the Interagency Agreement that was signed by the Growth Management Data Network Coordinating Council members and which became effective September 1, 1989.

This Agreement sets forth the terms under which the members (and ex-officio members) of the Growth Management Data Network Coordinating Council shall implement the conditions specified in Florida Statutes s.282.403. The terms in this Agreement serve to facilitate coordination for the development of more effective and efficient means to make information available for growth management decisions. The parties to this Agreement have determined that geographic or spatial data is essential for effective interagency and intergovernmental management of Florida's growth. As a result, Geographic Information Systems (GIS) are the focus and framework for the execution of this Agreement. In consideration of the mutual undertakings of the parties hereto, the parties to this Agreement shall:

- Promote the sharing of data related to growth management;
- Promote consistency of data elements related to growth management;
- Adopt common data elements and formats for interagency transmission of growth management data; and
- Prevent the duplication of effort associated with the collection of growth management data.

Article II—Definitions

As used in this Agreement, the term:

- **Base Map** means a graphic representation at a specified scale of selected fundamental map information used as a framework upon which additional data of a specialized nature may be compiled.
- **Cadastral Survey** means a survey relating to land boundaries and subdivisions, made to create regions suitable for transfer or to define the limitations of title.
- **Control** means a set of survey points within a network of basic control with known horizontal and elevation coor-

dinates to a specific accuracy.

Horizontal: First Order	1:100,000
Second Order	
Class I	1: 50,000
Class II	1: 20,000
Third Order	
Class I	1: 10,000
Class II	1: 5,000

Each numerical criterion is the maximum allowable value of the ratio of the standard deviation of the distance between a pair of survey points to the actual distance between those points.

Vertical: First Order	
Class I	0.5
Class II	0.7
Second Order	
Class I	1.0
Class II	1.3
Third Order	2.0

Each numerical criterion is the maximum allowable value of the ratio of the standard deviation of the elevation difference (in millimeters) between survey points to the square root of the horizontal distance (in kilometers) between those points (traced along the level route).

• **Control Network** means a set of interconnected survey points with accurately determined horizontal and/or vertical coordinates determined to a specific accuracy.

• **Control Station** means a permanently monumented point whose horizontal and/or vertical location is used as a basis for determining locations of other points.

• **Data Dictionary** means a dictionary of variables used in computer systems. Each term is described and cross referenced to other terms within that system.

• **Data Element** means a basic unit of information having a unique meaning and which has subcategories (data items) of distinct units of value.

• **Data Format** means a description of how a data element is represented in terms of computer storage.

• **Data Set** (or file) means a high level collection of data elements in a prescribed arrangement with a common purpose or meaning.

• **Datum** means any quantity or set of such quantities that may be used as a reference or basis for calculation of other quantities.

Datum: A set of constants specifying the coordinate system used for geodetic control, i.e., for calculating coordinates of points on the earth.

• **Florida Digital Spatial Database System** means a system of independently operated and maintained digital spatial databases that meet the standards set forth in this agreement and are of multi-agency value.

• **Geodetic Reference System** means a set of marked points whose relative locations have been accurately determined. Such a system has several distinctive features: a collection of permanently marked and maintained points; coverage of an extensive area; a spatial relationship (inter-connectivity) of known accuracy; relationships expressed in a common mathematical language or in a language translatable into other languages; and universal availability of geodetic information.

• **Geographic/spatial data** means entities that can be located by coordinates representing a specific location on the earth.

• **Geographic Information System** means a system that allows the user to perform analytical functions on the spatial data and nonspatial attributes simultaneously. Also included are systems that manipulate or graphically illustrate spatial data (e.g. CAM's).

• **Global Positioning System (GPS)** means a satellite-based navigational and positioning system. The locations of a point on or above the earth's surface can be determined using a special GPS receiver at that point by mathematically interpreting signals received simultaneously from several of a constellation of GPS satellites.

• **Growth Management Data** means the land use, natural resources and demographic information necessary to make appropriate and informed decisions for guiding our future growth.

• **Monument** means the structure that contains the point that marks the position of a survey station.

• **National Map Accuracy Standards** means the standards for published maps as defined by the U.S.G.S.

• **Network Densification** means a survey network connected to and contained within a survey network of the same or higher order.

• **North American Datum of 1927 (NAD 27)** means the horizontal control datum that is defined by a specific location and azimuth on the Clarke spheroid of 1866, with origin at Meades Ranch. The geodetic positions of this system were derived primarily from an adjustment of the triangulation of the entire country.

• **North American Datum of 1983 (NAD 83)** means the horizontal control datum for the U.S., Canada, Mexico, and Central America, based on a geocentric origin and the Geodetic Reference System 1980. The projected datum resulting from redefinition of the North American networks. The new adjustment includes a variety of geodetic data acquired since NAD 27 was determined. NAD 83 is the official horizontal datum for all horizontal control points in NGRS as published by NOAA's NGS.

• **Public Land Survey System (PLSS)** means the original survey system for all states in the United States excluding the original colonies and Texas. This system represents the original survey for the majority of the land area in Florida breaking down the land into section, township and range.

• **Shall** means a requirement, attribute, or condition which cannot be waived and from which a material deviation may not be made.

• **Should** means a desirable requirement, attribute or condition, but one which is permissive in nature and may be waived.

• **State Geodetic Reference System** means a sub-set of the National Geodetic Reference System (NGRS) plus other geodetic points in a state that are tied to NGRS.

• **State Plane Coordinates** means the plane-rectangular coordinate system established by the National Geodetic Survey, one for each state in the U. S., for use in converting

geodetic positions (latitude and longitude) to plane-rectangular (x,y) coordinates. Each state in the U. S. has a plane coordinate system which is based on one or more zones of either the Lambert conic conformal projection or the transverse Mercator projection. The Lambert projection is used in states having a large east-west direction; the transverse Mercator projection is used for states with a longer north-south dimension.

• **Structured Information System Development Methodology** means a structured methodology for executing the decision making process for the design and development of a computer system.

• **Survey Control** means a system of survey monuments which provides coordinates (horizontal and vertical) to which other surveys may be adjusted to the earth's surface.

Horizontal Control: Control established by GPS, triangulation, trilateration, or traverse, connected to form a system of loops or circuits extending over an area.

Vertical Control: Lines of spirit or other differential, geodetic leveling connected to form a system of loops or circuits extending over an area.

• **System Functional Requirements** means a study that determines the performance capabilities that a computer system will require in order to meet the needs of the user.

• **Vertical Datum** means a set of fundamental elevations to which other elevations are referred.

Article III—Terms of The Agreement

Parties to this agreement shall take action within the purview of their statutory authority and resources to comply with the standards and conditions specified in the following terms:

1.0 Florida Digital Spatial Database System and Management Structure

Agencies shall work together to create a system of independently operated and maintained digital spatial databases that meet the standards set forth in the terms of this agreement.

Standard 1.1 Agencies shall work together to develop and adopt, for use by all parties to this agreement, common minimal standards of content, format and accuracy for the State of Florida Digital Spatial DataBase System.

Standard 1.2 Within each agency, management priority and support shall be given to the organization and execution of work necessary for reaching consensus about agency responsibility for growth management data development, maintenance and exchange.

Standard 1.3 Agencies shall work together to develop a management structure for the further development, application and review of the standards set forth in this agreement. The management structure should provide a mechanism to facilitate data exchange and avoid duplicative and uncoordinated data collection activities.

2.0 Formal Spatial Data Transfer Specifications

The adoption of the following two elements of the Spatial Data Transfer Specifications (SDTS), as proposed by the United States Geological Survey, will set the stage for the adoption of the complete set of Spatial Data Transfer Specifications once they have been accepted by the National Institute of Standards and Technology. New systems should begin implementation of the data dictionary and data quality component as part of systems development; existing systems should develop a schedule for implementation.

Standard 2.1 All data sets to be included in the Florida Digital Spatial DataBase System will have a data dictionary that conveys the meaning of entities and attributes, the relationship between entities and attributes and the relationship between attributes and value domains.

Standard 2.2 All data sets to be included in the Florida Digital Spatial DataBase System will have a data quality assessment report which consists of five sections with comments covering lineage, positional accuracy, attribute accuracy, logical consistency and completeness.

Standard 2.3 Agencies shall use the appended guidelines for the Data Dictionary and the Quality and Accuracy Report (see Appendix).

3.0 Informal Spatial Data Transfer

It is recognized that the transfer of data via SDTS as specified in Standard 2.0 is not always the most appropriate method of transfer and of course is not possible at this time as explained above. With this in mind the following "Informal Methods of Spatial Data Transfer" are recommended.

Standard 3.1 DXF Transfer Format

The use of AUTOCAD Drawing eXchange File (DXF) files to transfer automated mapping data sets between Computer Aided Drafting and Design (CADD) environments are appropriate. This standard should be for DXF files produced using Version 10 of AUTOCAD.

Standard 3.2 DLG III Optional Transfer Format

The use of the Digital Line Graph (DLG) distribution format (see appendix) for the transfer of data between dissimilar systems is appropriate.

Standard 3.3 Raster data format

Processed raster data should be either band interleaved by line or band sequential by line. A leading header record or separate header file should contain the following minimum fields: initial line (y-coordinate), initial element (x-coordinate), last line (y-coordinate), last element (x-coordinate), number of channels, upper left projection coordinates, pixel size. This information should also accompany any digital data exchange as hard copy.

4.0 Florida Spatial Data Directory

The Florida Spatial Data Directory is an automated index to existing sources of spatial data about the State. Although the Office of Planning and Budgeting will operate and maintain the Directory, it needs the active and continual support of all participating agencies to be an effective tool for the sharing of data and the reduction of duplicative data collection activities.

Standard 4.1 Agencies shall participate in the survey for data sources to develop The Florida Spatial Data Directory.

Standard 4.2 Agencies shall update The Florida Spatial Data Directory as new data becomes available.

Standard 4.3 Agencies shall participate in the creation of consensus definitions of spatial data entities and optimize opportunities for streamlining data reporting and collection responsibilities.

Standard 4.4 Agencies shall consult the Florida Spatial Data Directory to identify opportunities for data sharing as a method to avoid duplicative data collection.

5.0 Standards for Geographic Information Systems

Agencies shall adhere to the following standards in the execution of tasks pertaining to planning, geodetic referencing, surveying, mapping and base map development for geographic information systems.

5.1 Planning Requirements for Geographic Information System Development Geographic Information Systems should be developed according to an agency defined and adopted information system development methodology.

Standard 5.1.1 At a minimum, agencies shall address all phases in the information systems development life cycle including: the data collection and data sharing plan; the operation, users, and data requirements of the existing system; the major functional requirements of the proposed system; the potential users of a GIS; products required by users, digital and hardcopy; data volumes and production rates the GIS will be required to meet; the data base required to sup-

port GIS implementation; a cost/benefit analysis; and project management plan (see appendix).

5.2 Geodetic Reference Framework

Standard 5.2.1 A system of geodetic control should be designed to fit the needs of the map being created for a GIS which is predicated upon an analysis of cost to the system functional requirements and their benefits.

Standard 5.2.2 All Geographic Information Systems shall preserve the capability to input and output geographic coordinates (longitude and latitude).

Standard 5.2.3 The preferred horizontal control datum is the North American Datum of 1983 (NAD 83). All mapping, survey control monuments and land corners referenced to the North American Datum of 1927 and to other datums shall be scheduled for conversion to the NAD 83.

Standard 5.2.4 Use of global positioning system (GPS) technology should be considered for systems requiring higher-order control.

Standard 5.2.5 For geographic information systems requiring a high level of accuracy, such as those systems that support the analysis of property boundary line data or infrastructure planning, the spacing of higher-order survey control stations shall be at 3-mile intervals with a maximum spacing of 10 miles (second-order class II or higher as defined in standards and specifications published by the Federal Geodetic Control Committee).

Standard 5.2.6 All Global Positioning System (GPS) surveys, when used in a relative positioning mode, shall be tied to the Florida high precision GPS network as appropriate.

Standard 5.2.7 Lower-order control monuments should be spaced at 0.5 to 1 mile intervals in urban areas, and 1 to 2 mile intervals in rural areas (lower-order control defined by third-order, Class II standards and specifications published by the Federal Geodetic Control Committee). Policies shall be adopted that require ties of conventional survey methods to the state geodetic reference framework.

Standard 5.2.8 County and city surveyors should plan for the densification of lower-order control, maintenance of the geodetic reference framework, and coordination of existing land parcels.

5.3 Land-Parcel Mapping and Surveying

Standard 5.3.1 All surveys and resurveys for land parcel mapping shall be referenced to the NAD 83. State funded Surveying activities, including route surveys, acquisitions, wetland surveys, etc., shall also be tied to the NAD 83.

Standard 5.3.2 Policies shall be adopted which support the establishment of central repositories for surveys and survey information.

Standard 5.3.3 Certified Corner Records (Chapter 177, Part III, Florida Statutes) filed as a result of public funded surveys should indicate the State Plane Coordinate value of the PLSS corners used to make the survey.

Standard 5.3.4 The establishment of a PLSS corner data base should be supported. This data base should be used by all public agencies to allow consistent mapping of land parcels, and should be updated as more accurate information on PLSS corner locations are obtained.

5.4 Base Maps

Standard 5.4.1 The horizontal and vertical accuracy of all base maps should meet the specifications of the large scale mapping standards of the American Society for Photogrammetry and Remote Sensing. At a minimum, horizontal accuracy should meet National Map Accuracy Standards.

Standard 5.4.2 Data digitized from U.S.G.S. quadrangle sheets should be referenced to the published NAD 83 Coordinates of the quadrangle sheet corners (see appendix).

5.5 Thematic Maps

Standard 5.5.1 Thematic maps shall be compiled on or adjusted to a base map that complies to standards 5.3 and 5.4.

Article IV—Limitation of Liability

Parties to this Agreement shall not be responsible to each other or to any third parties, for any loss incurred, whether financial or otherwise, directly or indirectly related to the use of any data furnished pursuant to this Agreement.

Article V—Commencement, Amendment and Termination of the Agreement

This Agreement became effective on September 1, 1989, and is amended on this date by mutual agreement. This agreement may be amended to include additional parties and

terms. The Terms of the Agreement may be changed at any time by written modification agreed upon by all parties.

All decisions reached in the terms stipulated in Condition 1.0, Article III shall be acceptable to all concerned parties.

Should disagreement over the terms of the Agreement arise, all parties shall attempt to resolve the dispute. In the event a dispute cannot be resolved, any party may terminate from the agreement upon written notice.

In witness hereto, the parties have executed this Agreement by their duly authorized officials.